by the approved formula for compounding the pargetting for chimney-flues.

59. The inferior water-cements are very serviceable for bedding brick—or flag—paving in damp situations.

60. An excellent cement for outside plastering is formed by slaking 100 parts of quicklime in water just sufficient for that purpose, then reducing it to the substance of cream; also diluting five parts of either white or coloured clay to a like consistency, and, after a while, mixing it carefully with the other. After remaining in the tub for twenty-four hours, during which it is frequently stirred, it is coloured by an addition of two parts of yellow ochre; this is a very tenacious coating, and one that resists to a high degree the action of wind and rain. Another facing for houses is composed of limestone and road-dust, or sand, reduced to powder and heated in an oven, and one-fourth part of tar, pitch, or rosin, added while the other ingredients are hot.

61. BAILEY'S CEMENT, for stuccoing, consists of three parts Dorking lime, and one part clean, fine, river sand, and is kept mixed dry, in air-tight casks, till used, when it is made into mortar, and applied and finished in the usual manner, the walls being prepared for it by a thick wash of the same material.

62. ROUGH-CAST is a cheap substitute for outside stuccoing, in which the smoothing operation, called floating, as well as the ashlaring, or lining, to imitate masonry, are dispensed with.* It is executed by first giving the works a coat of hair-mortar, sufficiently rough on its face to receive when dry another coat of the same. The second is laid on tolerably evenly, and is immediately covered with the third coat, or rough-cast, which is composed of clean, fine gravel, the largest stones scarcely so big as a pea, mixed in a trough with lime and water to a semi-fluid consistency, and with a tool similar to a dust-shovel dashed upon the work, so as to adhere firmly to the second coat, while still soft; when dry, it is generally teinted with a stone-coloured wash, which gives it an uniform and finished appearance.†

63. ATKINSON'S CEMENT is, in quality, similar to Roman cement, but of better colour. It is often preferred for ornamental work in dry situations; but being more absorbent, is inferior for construction: it does not set so quickly as the Roman cement.

(*To be continued in our next.*)

PETRALOGY, OR THE KNOWLEDGE OF ROCKS AND STONES.

BY HENRY O. MONTAGUE, ESQ., PROFESSOR OF NATURAL PHILOSOPHY.

(*Continued from p. 242.*)

Siliceous Rocks.

QUARTZOSE ROCKS;—consisting of silica only, or uniting in their semi-crystalline structure small quantities of other earths and mineral aggregates, as plates of mica, felspar, metalline bodies, &c.

HORNBLENDE ROCKS, consisting chiefly of silica, iron, magnesia, and lime; the union of quartz and horneblende produces varieties, the introduction of schorl, garnet, and mica is productive of other varieties; these rocks are generally laminated.

FELSPATHIC ROCKS: quartz, embracing potash and alumina, and sometimes lime and metalline earths; they are of innumerable varieties.

GRANITE;—said to be a corruption of *granites*, a term applied by Pliny to a stone of the colour of a stork's neck, and originating with Italian antiquaries.

Of the varieties of rocks distinguished from each other by the peculiarity of their composition and character, none lay higher claims to our admiration than this very extensive class, or are more really deserving of notice: the hardest and most ponderable rocks we are acquainted with, they are at the same time capable of receiving the highest and most exquisite polish, and are therefore equally desirable for the exterior of buildings, for casing canals, for bridges, lighthouses, temples, palaces, and prisons, and for the wear and tear of machinery, as they are for the ornamental interior of public and even private edifices of magnitude. In their natural state granites constitute the bases, and very often the chief material of many elevated portions of the earth, being the most common matrix of the metals, and of some of the precious stones. In its simple primary state it is chiefly quartzose uniting with iron, magnesia, and lime, and consisting of parts variably disposed, without any determinate order, silica forming the common bases of the whole aggregate mass,—the earths of which it is composed, and from which it is produced, being exclusively oceanic. In the changes produced by local influences, we observe the fossil bed consisting of the oceanic animal and vegetable reliquæ, or the earths produced by their decomposition gradually assuming its determinate form, the shelly coverings of the mollusca silicify—veins of quartz intersect the calcareous mass—by degrees the whole becomes cemented together, the common flinty bodies assume the crystalline form, the cementing material is embraced in the crystalline or granular structure, and the ultimate result is granite. In all these changes, we observe that the several aggregate bodies pass through slow and progressive stages of change, the act of silicifying, or, as it is universally but most erroneously termed, petrifying, being gradual, and depending on the conditions to which it is exposed, and the final act of crystallization being produced by the gradual displacement of calcareous and other earthy matters. All siliceous bodies, such as flints and other common stones, gradually assume the crystalline form, under certain conditions of atmospheric heat and moisture, unless prevented from doing so by being united with some earthy compound inimical to further change; and so far from lateral pressure being necessary to produce crystalline bodies, as is generally affirmed by geologists, and weakly demonstrated by the experiments of Sir John Hall, it is absolutely necessary for the right development of the regular crystalline structure, that there be a perfect freedom from lateral pressure which is palpably manifest in the act of crystallization of rocks, for invariably, in the first instance, the matter is simply cemented together, and in this state it is enabled to resist the pressure of surrounding bodies, the earth or earths being held in union by the one common basis. When we examine a mass of matter thus agglutinated together, it conveys no idea of any further change, but all bodies, organic and inorganic, are the subjects of unintermitting change in the disposition of their quantities and qualities, and although there is an apparent *vis inertia*, or state of absolute rest, in rocks and stones, and consolidated beds of the earth, all of them in reality are the subjects of incessant change; thus the simply agglutinated mass goes on changing, some of its elementary constituents being abstracted, and the vacancy thus produced being filled up as it takes place by the expanding body, which, divested of its impure mixtures, assumes another form.

The largest aggregate masses of the earth are governed in their combinations and changes by the same laws that govern the disposition of the smallest particles of matter, and every atom, being a component part of a large consolidated body, must have room to change its place and disposition, to act and to be acted upon; otherwise, like sandstone, it continues a mere heterogeneous mass of particles mechanically united and readily separated from each other. The crystalline texture of granite depends upon these conditions, and the more room the siliceous aggregates have to expand, the larger is the crystal, and consequently the coarser the granite. The same law is observable in crystalline carbonates of lime; they generally form (or, as is palpably manifest by their disposition and qualities, they have been formed in preceding epochs) upon or near the surface of the earth, and previous to assuming the crystalline state were permeable to all fluid bodies, and, becoming the recipients of particular fluids, crystallized by expansion of their atomic particles.

Geologists inform us that granite is primary rock, formed of matter once in a state of fusion; and this unphilosophical notion is made the basis of modern systems of geology; but the very confused and uncertain nature and disposition of the material is of itself sufficient to compel us to negative this supposition, independently of facts derived from travel and observation in various parts of the earth. It passes by transition into all kinds of rock and under all circumstances its elementary constituents are identified with the varied beds of the earth, from which, by cohesion and subsequent crystallization, it is even now being produced. The substances of which the strata are principally composed are siliceous, calcareous, and argillaceous earths, the two first being chiefly produced within the ocean, being the resolution of oceanic animal and vegetable bodies; the latter is produced by the resolution of animals and vegetables of *terra firma* united in variable proportions of each; all these several beds exhibit more or less organic remains of species allied or analogous to those now existing, and by their union with each other produce the varied phenomena; the agglutination of calcareous matters causing them to pass into limestone, of clay into slate, and of siliceous matters in sandstones; the further change or crystallization producing peculiar results, as marbles, jaspers, granites, &c. The organic remains entombed at various depths, and very often disposed in groups and families, demonstrate that the strata were deposited over each other at distant intervals of time, and that each stratum in which they occur and under which they were formed was once the uppermost stratum of the globe, there being a manifest period of time in which species have uninterruptedly lived and propagated their kind; the materials of such strata could not therefore have been suddenly brought together. Again, they everywhere manifest conversion of calcareous animals into simple carbonate of lime, the conversion of vegetable bodies into vegetable earths and their transition into clays and shales, demonstrates that organic matter ever ultimately assumes form in which all traces of its original bodies are for ever obliterated. The absence of organic remains in granite cannot therefore be adduced as evidence of its primary nature, any more than limestone or slate recently formed and still forming from calx and clays.

Simple granite, according to geologists, consists of felspar and quartz, the component parts varying in their predomination; but, the presence of the former, which is a combination of silica, potash, and alumina, and sometimes lime, demonstrates, that it is a secondary product, the alumina and potash being derived from *terra firma*; whereas hornblende, which often replaces the felspar, is strictly oceanic, and therefore, as regards precedence of origin, is assuredly a primary product.

True granite consists of quartz, felspar, and mica, the latter being composed of the like ingredients of felspar, together with oxides of iron and manganese, and very indeterminate in its mixtures. Besides these ingredients true granite is sometimes mixed with other minerals as shorl, hornblende, crystals of garnet, steatite, and alumine: the felspar is often flesh-coloured, the quartz generally white, and rarely greenish; it is found in innumerable varieties of hardness, proportion, distribution, and colour of parts. It takes a very high polish, and for this reason has always been employed in architecture and other economical uses. Of these compounds quartz is invariably the first to assume the crystalline texture, and in doing so occasion the changes in the enveloped ingredients. Granite, in fact, is no other than conglomerate masses of earth which, united in the first instance by simple cohesion of parts, are more durably united by time and the accident of change, the particles and aggregates of which they are composed undergoing a simultaneous and progressive change from their petrefactive state to the crystalline structure, and their crystalline nature and composition depending upon the nature and composition of the primary beds. All granites are produced by sedimentary or mechanical deposition, the material of which they are composed being derived from organic depositions locally accumulating within the ocean. A deposition of pure sands, when no longer disturbed by the tidal action, and preserved from further change of position as a portion of *terra firma* becomes of necessity, in its whole aggregate mass, the subject of change when acted

* [Some old specimens of rough-cast are to be found, rusticated by smooth channelings, so as to resemble rustic masonry, some examples of which are to be seen at Highgate.—ED.]

† [Rough-cast, having projecting surfaces, which retain wet, is the least estimable kind of stucco, though if made with hydraulic lime, and afterwards trowelled smooth, it would perhaps, from its stony nature, be one of the best.—ED.]

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